United States
Department of
Agriculture

**Agricultural
Research
Service**

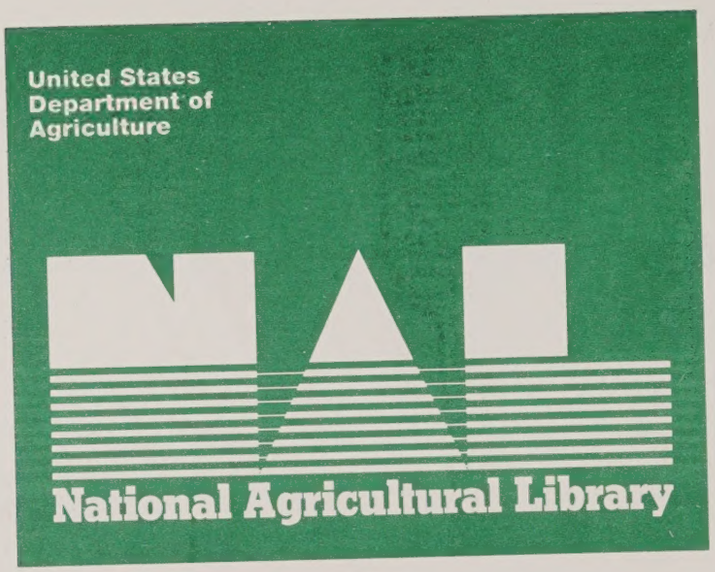
October 1991

Agricultural Research Service Program Plan

Implementation Plan—

6 Year

Executive Summary
1992-1998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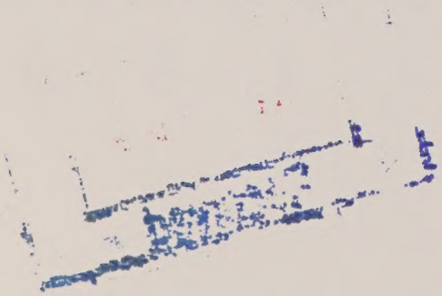


Foreword

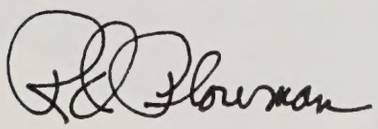
I am pleased to present the Agricultural Research Service (ARS) program implementation plan for the period 1992-1998. This document outlines those research programs to receive emphasis by the agency in the coming 6 years. Just as important, the plan describes the policies and strategies ARS will follow to acquire, deploy, and manage resources needed to carry out its research programs. The plan also addresses the need for human workforce forecasting and modernization of facilities to support future programs.

Today, agriculture faces a multitude of research challenges. Issues involving the environment and natural resource conservation, agricultural sustainability, food safety, human nutrition, waste management, animal well-being, and genetic resources have steadily moved to the forefront. The competitive position of U.S. agricultural products in the global marketplace must be bolstered, while demands for alternative energy sources are being raised more widely. The cutting edge of science, particularly bioscience, is advancing rapidly. ARS must keep up with that cutting edge if agriculture is to benefit from the innovations it will generate.

ARS identification of these many problems and research opportunities has emerged through joint planning and priority setting processes using inputs from numerous sources, including the Secretary of Agriculture, other USDA policy officials, Congress, research users, scientists, cooperators, and the general public. ARS program leaders have worked hard to assimilate these many inputs and reach a consensus on future program directions and areas of research emphasis within the ARS mission and available resources. The collective judgments are presented in this plan, but ARS will remain flexible so we can adapt to changing conditions and priorities, as necessary.

I want to emphasize the special working and planning relationships ARS shares with its fellow USDA agencies and with other performers and users of agricultural research in the state systems and the private sector, as we jointly plan, conduct, and coordinate our research. We have a particularly close relationship with the USDA Cooperative State Research Service (CSRS), the State agricultural experiment stations (SAES), and the 1890 Land Grant Institutions. In implementing future research, it is clear that we must all increasingly address issues of broad public and consumer concern in addition to continuing to be responsive to the needs of farmers and ranchers, the agribusiness sector, and other traditional users of agricultural research.

ARS has made considerable progress in accomplishing the goals and objectives established in the 1984 and 1986 program plans. I am convinced that ARS, with a dedicated workforce committed to scientific excellence, accountability, and public service, will meet the new challenges presented in this plan.



R.D. Plowman
Administrator

Agricultural Research Service Program Plan

6-Year Implementation Plan—1992-1998

Executive Summary

I. Introduction

The Agricultural Research Service (ARS) Implementation Plan is a principal means of informing ARS personnel, funders, clientele, and cooperators about the agency's research program objectives. This plan updates two previous plans covering 1984-1992.[1,2] It establishes areas of research emphasis for 1992-1998 and outlines ARS policies and strategies to achieve them. This updated plan reflects changing national needs and priorities including those presented in the 1990 Farm Bill.[3]

As the in-house research arm of the U.S. Department of Agriculture, ARS has a mission to:

> Develop new knowledge and technology needed to solve technical agricultural problems of broad scope and high national priority in order to ensure adequate production of high-quality food and agricultural products to meet the nutritional needs of the American consumer, to sustain a viable food and agricultural economy, and to maintain a quality environment and natural resource base.

ARS has primary responsibility to:

- Provide initiative and leadership in agricultural research.
- Conduct research on broad regional and national agricultural and related problems.
- Conduct research in support of Federal action and regulatory agencies.
- Provide technical expertise to meet national food, food safety, and environmental emergencies.
- Serve as an agricultural science resource to the executive and legislative branches.

ARS programs are centrally planned and coordinated. The agency manages the scientific and operational activities of 129 locations, which comprise a network of geographically dispersed national and overseas laboratories. Supported by appropriated funds, ARS provides:

- Ability to perform long-term, high-risk research.
- Ability to respond to stable and changing technical goals.

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[1] Agricultural Research Service Program Plan. 6-Year Implementation Plan, 1984-1990. U.S. Department of Agriculture, Agricultural Research Service. 1983. (Out of print.)
[2] Agricultural Research Service Program Plan. 6-Year Implementation Plan, 1986-1992. U.S. Department of Agriculture, Agricultural Research Service. 1985. (Out of print.)
[3] Public Law 101-624; November 28, 1990. Food, Agriculture, Conservation, Trade Act of 1990.

- An organizational structure ensuring research program accountability and coordination.
- Ability to focus research on gaps in knowledge that are barriers to problem solution.
- Capability to form, disband, or coordinate interdisciplinary or multilocation research teams from a large, diverse scientific workforce of over 2,600 research scientists, including postdoctoral research associates.

Challenges of the 1990's

Issues critically important to ARS' research mission include:

Environment. Public concern has increased about effects of air and water pollution on the environment, depletion of nonrenewable resources, waste management, and potential effects of global warming. At issue is the role of the agricultural sector as a contributor to or solver of environmental problems contrasted with the need to sustain supplies of agricultural products for domestic consumption and export.

Food Safety, Human Nutrition, and Health. Public concern over chemical and biological contamination of food during production and processing continues, with more recent concern over the safety of biotechnology products. Another concern is the relationship between diet and health, which is compounded by the complexities of nutrition.

National Economy. Since the U.S. share of the agricultural export market has slipped from peak levels in 1980-1981, lowering costs, adding value, and improving quality of U.S. agricultural products are potential ways to reduce the trade deficit, boost U.S. market share, and otherwise enhance U.S. agricultural competitiveness.

Scientific and Technical Approaches. Scientific research is changing, driven by major trends:

- Increased use of biotechnology, interdisciplinary teams, and computer automation.
- Increased dependence of the private sector on public research capabilities, particularly for fundamental and pre-market research.
- More effective transfer of new knowledge and technologies to users or further developers. Public/private sector research collaboration is a growing component of this positive trend.

ARS Response to These Challenges—The Implementation Plan 1992-1998

The research challenges of the 1990's have critical policy, program, and operational implications for ARS. Section II broadly describes ARS progress in implementing strategies and program priorities laid out in the previous versions of the plan and profiles current (1991) ARS base resources—funding, personnel, and facilities. Program priorities are identified as areas of research emphasis in section III. Section IV describes how ARS will implement its program within the limits of its fiscal, human, and physical resources.

II. ARS 1991 Status—Planning Base

Research Progress

For research planning and resource allocation purposes the ARS program is divided into six areas, termed objectives:[1]

Objective 1—Soil, water, and air

Objective 2—Plant productivity

Objective 3—Animal productivity

Objective 4—Commodity conversion and delivery

Objective 5—Human nutrition

Objective 6—Integration of systems

The objectives are further divided into scientific approaches, then into approach elements.

Fulfillment of Previous Implementation Strategies

Selected examples in appendix D show ARS progress in implementing the previously planned strategies, which were:

- Adhere to mission-oriented research.
- Address technical problems determined to be most critical to the U.S. agricultural sector.
- Allocate resources to solve specific high-priority national problems.
- Increase use of interdisciplinary teams in problem solving.
- Institute and expand integrative systems research.
- Augment research to increase the efficiency of production and marketing.
- Develop communication networks and data-management systems to support research and facilitate technology transfer.

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[1] Agricultural Research Service Program Plan. U.S. Department of Agriculture, Agricultural Research Service, Miscellaneous Publication 1429. 1983. (Out of print.)

Current Status—Funding, Personnel, Facilities

Funding

- Although appropriations to ARS increased by 47 percent between 1982 and 1991, the real purchasing power increased only 7 percent because of an inflation of almost 37 percent over the same period.
- Total dollar levels required for conducting research projects have increased. The 1991 figure is 67 percent higher, $250,000 per scientist year. Thus, the ARS budget currently supports fewer career scientists and research projects than in previous years.
- There has been little change in the balance of funding between ARS research objectives, although significant changes in research direction have been made within objectives. ARS continues to respond to user expectations and be accountable for appropriations.

Personnel

- ARS is at its currently authorized personnel ceiling of 8,200 full time equivalents, including about 2,600 permanent and temporary scientists. The ceiling has changed little since 1986, and no significant future changes are expected.
- Through normal attrition, ARS expects to turn over about 36 percent—780 positions—of its permanent scientist workforce in the next 6 years. ARS must redeploy these positions wisely.
- ARS disciplinary structure is already changing to meet the new demands of emerging programs and science. One means has been an increase in postdoctoral appointments in 1991 to 14 percent of the total ARS scientist workforce, from 7 percent in 1986 and 1 percent in 1982.

Facilities

A forward-planning program of facilities renovation and modernization (R&M) to meet the challenge of an aging ARS infrastructure has been underway for several years. Assessment of the current situation is as follows:

- ARS' real property inventory includes nearly 3,000 separate buildings and facilities that comprise about 12 million square feet of floor space. The current replacement value of these and other capital improvements is about $1.7 billion.
- A significant part of this real property needs renovation or replacement to adapt to safety, health, and other regulatory code requirements and to meet technical demands of future research programs.
- From 1987 to 1990, ARS allocated about $106 million in base program and special appropriated funds to R&M (about $26.5 million per year).
- Current plans for 1992 to 1998 project a need to double annual expenditures for facility modernization.
- ARS facility improvement priorities will be driven by program needs.

III. ARS Program Strategy—1992-1998

Areas of research emphasis for ARS during the 1992 to 1998 period respond to high-priority problems identified by scientists, internal ARS program evaluation, users, new legislation, appropriations, action and regulatory agency concerns, and executive branch initiatives.

Base Program

Objective 1. Soil, Water, and Air

- Improved production systems for reducing the degradation of water quality by agricultural chemicals and controlling erosion under low-crop-residue conditions.
- Strategies for off-site control of chemical buildup in ground water.
- Technologies for improving chemical application efficiencies; using agricultural, municipal, and industrial wastes to improve soil productivity; and delineating land areas vulnerable to soil degradation.
- Methods for assessing the effect of potential global climate change on water and energy fluxes, water resources, and the health and sustainability of agroecosystems; for quantifying agriculture's contribution to the fluxes of greenhouse gases; and for facilitating conservation tillage.
- Evaluation and optimization of no-till and other conservation tillage and residue management systems to increase soil organic matter, infiltration, and soil biological activity and to reduce runoff, erosion, evaporation, and drought damage.

Objective 2. Plant Productivity

- Enhancement of plant germplasm by genome manipulation at the molecular level and of plant genetic resources to overcome productivity barriers in major crops.
- Technologies for controlling fundamental biological processes relating to productivity, market quality, and production costs; long-and short-term acquisition and preservation of plant germplasm; and detection at the molecular level of pathogens in propagative material.
- Methods for nondestructive testing of seed viability and composition and for environmentally safe pest control with acceptable health risk.
- Management systems for sound ecosystem maintenance and water use on important range, pasture, and crop lands (including horticultural crops); weed and plant disease control; and areawide control of high-priority pests.
- Development of a relational database for the National Plant Germplasm System.

- Computer simulation models for growth and development of economically important crops and weeds.

Objective 3. Animal Productivity

- Means to reduce mortality and other losses from disease and parasites, improve—at the molecular level—genetic resistance to diseases and parasites, use biologically based control of parasites, control zoonotic bacteria and parasites in the live animal, increase the genetic capacity of animals for greater production, and evaluate behavioral, physiological, and productivity indicators of animal well-being.

- Elucidation of physiological processes involved in feed intake and metabolism and mechanisms by which chemical and physical composition of feed limits nutrient availability.

- Technology for nondestructive repeated measurements of body composition.

- Means to use animal wastes and means to reduce waste contamination of surface and ground water.

Objective 4. Commodity Conversion and Delivery

- Means to prevent or eliminate foodborne microorganisms in animal products, prevent mycotoxins in food and feed products, eliminate insect and disease trade barriers limiting agricultural exports, meet commodity quality market requirements (physical, sanitary, performance), and extend shelf life with sensory quality retention.

- Methods for rapid, objective analysis of marketing safety and quality characteristics.

- Technologies for conversion of agricultural commodities to value-added industrial products, alternative fuels, and new fiber, leather, feed, and food products; process treatments to enhance food safety, minimize residues or additives, and retain quality; and alternative environmentally benign processes and products.

Objective 5. Human Nutrition and Well-Being

- Methods to determine composition of commonly consumed foods for several nutrients and phytogenic components and to change food production and processing systems to improve food nutritional quality.

- Elucidation of role of dietary components in weight maintenance and risk of chronic diseases, adequate and safe ranges of nutrient and calorie intake, and molecular and cellular basis of human nutrition.

Objective 6. Integration of Systems

Areas of emphasis for objective 6 are included under objectives 1 through 5 where appropriate. Integrative systems research aimed at more general goals will be a critical component of planning and setting priorities for related implementation strategies.

High-Priority ARS Special Programs

ARS Plant Genome Program/Animal Genome Program

- Gene construction for broad genetic similarities and differences for useful gene maps of major species.
- Gene construction for important economic traits of major species for which some data already exist.
- Development of new mapping and sequencing technologies; electronic data management for data access and dissemination; and robotics and automation for new, automatic DNA processing procedures.
- Identification of genes or groups of genes responsible for desired productivity traits and resistance to diseases and parasites.
- Application of new knowledge and techniques to modify plants and animals so as to improve production efficiency, nutritional quality and safety of food, and U.S. competitiveness in export markets.

ARS Global Climate Change Research Program

- Climate and hydrologic systems that will affect policy responses to greenhouse and atmospheric warming, water supplies, food security, biochemical dynamics, ozone depletion, biological productivity and diversity, and forestation.
- Ecological systems and dynamics and causes and effects related to how ecosystems cause global change and how they are affected by global change.

ARS Utilization Research Program

- Substantial-value-added products such as chemical pesticide substitutes, edible films, biodegradable industrial and food products, industrial enzymes, and food additives.
- High-value-added products such as biomedical and veterinary products, essences, attars, and flavors.
- Moderate-value-added products such as bulk fermentation chemicals and replacements for significant imports such as latex, vegetable gums, and specialty vegetable oils.

High-Priority ARS Crosscutting Programs

Food Safety

- Reduction or elimination of introduced toxicants, with emphasis on chemical contaminants, mycotoxins, and toxin-producing and pathogenic microorganisms.
- Reduction or elimination of toxins that occur naturally in plants and cause stock losses in animal production, transfer to animal products, or occur in plants that are directly consumed by humans and are potentially significant to human health.

Improved Human Nutrition and Health

- Definition of human nutritional requirements for optimal function and safe limits of energy and nutrient intakes through the life cycle, with emphasis on infants, pregnant and lactating women, and the elderly.
- Research on molecular and cellular basis of human nutrition to yield data applicable to reduction of risks associated with obesity and chronic disease.
- Research to determine the bioavailability of nutrients important to health in agricultural products as eaten.
- Development of methods to assess marginal nutritional status under field conditions.
- Development of biotechnology, management, and processing strategies to change food production systems that will enhance the nutritional value of animal and plant foods.

Water Quality Protection

- Research to assess agricultural effects on water quality, with emphasis on fundamental processes affecting fate and transport of agricultural chemical contaminants and evaluation of current agricultural practices.
- Development of new agricultural practices and systems to remediate or preclude water quality problems in cropping areas and to reduce effects on other ecosystems.

Environmentally Compatible Pest Control

- Fundamental research to unravel complexities of microbial and other biological associations that affect efficacy of biological control agents.
- Development of new systems for pest management designed to keep pest populations below the economic damage threshold, including host genetic resistance.
- Development of crop cultural practices complementary to cultivars with genetic resistance to pests.
- Research leading to development of alternative disease management strategies.

Section IV. Implementation Strategy 1992-1998

1. ARS will continue to carry out that research necessary to solve specific, identified problems. ARS will use a total quality management (TQM) and integrated systems-based approach to research planning.

2. ARS will continue to depend on sustained appropriated funds for its base programs.

3. ARS will aggressively seek annual budget increases to address new priority research needs and to strengthen important base programs.

4. ARS will seek outside funding support to supplement or accelerate in-house programs consistent with base-funded project objectives and the accountability requirements of the Department, Congress, and research users.

5. ARS will not depend on new or outside funds alone to address priority research, but will manage and effectively deploy its existing base resources to address its most important research objectives and approaches.

6. ARS will maintain research projects at well-funded levels adjusted for inflation (current projections are $250,000 per year for each career scientist). Resource redeployment decisions will use established decision criteria.

7. ARS will develop means to implement long-range workforce planning to meet the challenges of projected scientific needs, increase cultural diversity and achieve other Equal Employment Opportunity objectives, and properly reward its scientists for contributions to achieving ARS' mission, goals, and objectives.

8. ARS will systematically upgrade and modernize its facilities and seek budget allocations to augment its limited base resources for this purpose.

9. ARS will develop multiyear operational planning by line (area) management and integrate its planning process into long-range strategic planning.

10. ARS will improve its support functions, especially the technology transfer operations, to achieve planned agency goals and objectives.